Michael

TRAFFIC SPEED REPORT NO. 63
TRUCK WEIGHT - SPEED STUDY

DEC., 1957
NO. 34

by
C. Pinnell

Joint Highway Research Project
PURDUE UNIVERSITY
LAFAYETTE INDIANA

PROGRESS REPORT

TRAFFIC SPEED REPORT NO. 63

TO: K. B. Woods, Director
Joint Highway Research Project

December 18, 1957

FROM: H. L. Michael, Assistant Director

File: 8-3-4
Project C-36-10D

Attached is Traffic Speed Report No. 63. This is the report of the annual truck weight speed study that is made in cooperation with the State Highway Planning Survey of the State Highway Department of Indiana. The report has been performed by Mr. Charles Pinnell, Graduate Assistant of our staff. Mr. Suwarto Hardjodipuro assisted in the collection of data. This study indicates that the average weight of single unit trucks increased over 1956 but that the weight of semi-trailer trucks decreased in the past year. The speed of multiple unit trucks was also less in 1957 than in 1956.

In accordance with our usual practice, copies of this report will be transmitted to the Bureau of Public Roads, the Indiana State Police, and the Highway Planning Survey.

The report is presented for the record.

Respectfully submitted,

Harold L. Michael

Harold L. Michael, Assistant Director
Joint Highway Research Project

HLM:hgb

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Progress Report

TRAFFIC SPEED REPORT NO. 63
TRUCK WEIGHT - SPEED STUDY

by

Charles Pinnell
Graduate Assistant

Joint Highway Research Project
Project: C-36-10D
File: 8-3-4

Performed in Cooperation
With

The State Highway Planning Surrey
State Highway Department of Indiana

August 5, 8, 14, 15, 16, 21, 26, 27, 28, 30, 1957

Purdue University
Lafayette Indiana

December 18, 1957

INTRODUCTION

The Joint Highway Research Project of Purdue University cooperated with the Highway Planning Survey Unit of the State Highway Department of Indiana, in conducting the annual truck weight-speed study during August 1957. This was the thirteenth year in which such a cooperative study was made.

Prior to 1944, studies were limited to a determination of truck-weight distribution patterns and twenty permanent stations were selected for this purpose. The first truck weight-speed studies were made in 1944 and have been continued annually to the present with the exception 1945. When the truck weight-speed studies were initiated in 1944, speeds were taken at only four of the twenty truck-weight stations. From 1944 to 1950 the number of truck speed stations varied until 1951 when twelve stations were selected. The location and number of the truck weight-speed stations remained constant from 1951 to 1953. In 1954 and 1955, however, speeds were taken at only ten of the twelve stations used in 1953 and in 1956 only nine stations were studied. This year speeds were observed at ten stations.

The speed observations for this study were made with an Electro-Matic Radar Speed Meter. The meter was concealed as part of a rural mailbox and the observers concealed themselves as well as local conditions permitted. It is believed that the observation were taken without influencing the speeds of the vehicles. Before using the meter, it was checked for accuracy and calibrated in the speed range of 20 to 80 miles per hour.

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The speed data were collected by the writer and Mr. Suwarto Hardjodipuro and analyzed by members of the Traffic Engineering laboratory staff.

OBSERVATION PROCEDURE

The weight stations used for the coordinated truck weight-speed study, which are shown on the attached map of Indiana in Figure 1, were located as indicated below, and were operated on the dates noted:

Date	Station	Highway	Location	No. of Lanes
Aug. 5	68	U.S. 50	1.25 miles W. of W. Corp. limits of Aurora	2
Aug. 8	45B	S.R. 67	1.00 miles S.W. of Muncie	2
Aug.14	5	U.S. 30	1.30 miles E. of E. city limits of Bourbon	2
Aug.15	4	U.S. 31	1000' S. of Jct. of U.S. 6	2
Aug.16	2	U.S. 20	1500' W. of Jct. of S.R. 2	4
Aug.21	14	U.S. 41	0.50 miles S. of N. Jct. of S.R. 2	4
Aug.26	42	U.S. 52	600' S.E. of N. Jct. of S.R. 28	4
Aug.27	58B	U.S. 31	1000' S. of Jct. of Co. Rd. to Southport	4
Aug.28	75	U.S. 41	0.85 miles S. of S. city limits of Terre Haute	4
Aug.30	81	U.S. 150	0.50 miles E. of Jct. of S.R. 56	2

The speed stations were selected on the basis of topography and were located from one to three miles from the weight stations. The intervening distance between each weight station and the speed station

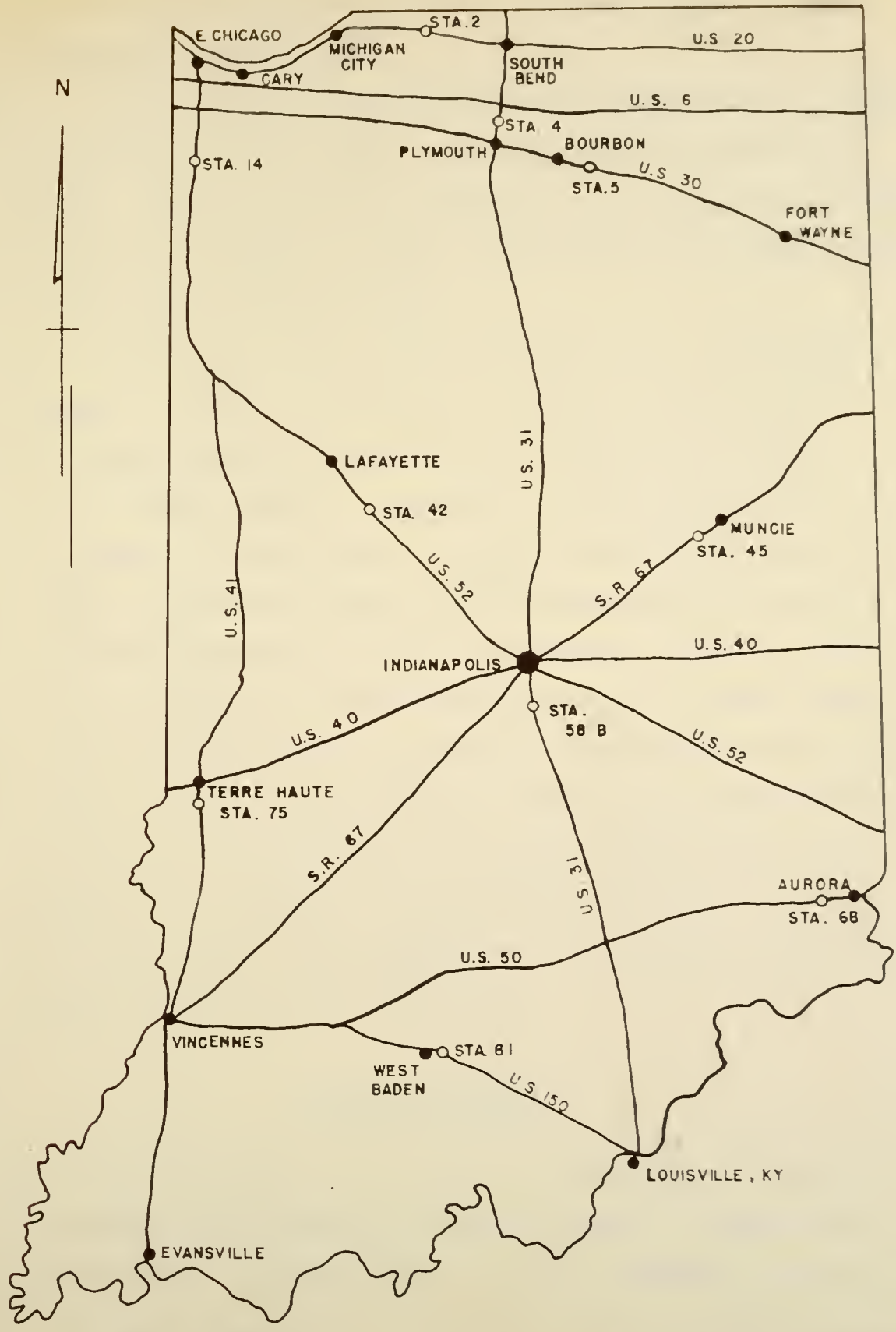


FIG. 1 LOCATIONS OF TRUCK WEIGHT - SPEED STATIONS

was sufficient to allow the trucks which had been stopped to regain their normal cruising speed.

The weighing crew, operating portable loadometer scales, stopped and weighed all trucks moving in a given direction for a four-hour period. During the succeeding four hours, trucks moving in the opposite direction were stopped and weighed. Each station was in operation from 6:00 A.M. until 2:00 P.M. C.D.S.T.

Speed stations were operated at the same time as the weight stations. At each speed station, the speed of each truck moving in the proper direction was recorded to the nearest mile per hour.

For the purpose of correlating the speed and weight data, both the weight crew and the speed crew briefly described each truck. The color, make of truck, owner and type of truck were listed as well as the time at which the truck passed each station. Information on all of the trucks passing the speed station could not be obtained. Some trucks turned off between the speed station and the weight station, some trucks parked until the operation was changed to the opposite direction and some trucks were by-passed at the weight station without being weighed due to congestion. Some trucks also were missed in the direction change-over on divided highways as it was necessary to move the radar unit to the opposite of the road.

REPORTING PROCEDURE

For the purposes of this report, all trucks were divided into two groups. These groups are single unit trucks and multiple unit, semi-trailers. The former group was further subdivided for some of

the analysis into those having a gross-weight of 5,000 pounds or more and those having a gross-weight of less than 5,000 pounds in order to compare the observed speeds of these units with the existing speed limits. The present legal speed limits for trucks are 45 miles per hour for trucks with a weight of 5,000 pounds or more and 65 miles per hour for trucks with a gross weight of less than 5000 pounds.

Table I provides the speed and weight data observed at each station for single unit trucks weighing less than 5000 pounds. Similar information is presented in Table I for all single unit trucks with gross weight greater than 5000 pounds. Table II is arranged in a manner similar to Table I in order to provide all speed and weight data for semi-trailer multiple units. The number and percentage of vehicles exceeding the legal and "enforcement" speed limits, by station, is presented in Table III. All-station accumulation curves for trucks and for semi-trailers are shown in Figure 2. Similar speed accumulation curves for trucks and semi-trailers on two-lane and four-lane highways are shown in Figures 3 and 4. A speed-weight comparison is presented in graphical form for trucks in Figure 5 and for semi-trailers in Figure 6.

The heaviest vehicle observed was a 3 axle tractor-truck with a 2 axle, tank-type semi-trailer having a gross weight of 85,200 pounds and traveling at a speed of 48 miles per hour.

The fastest vehicle observed was an empty, open pickup weighing 3400 pounds and traveling at 78 miles per hour.

Data for 1946, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, and 1956 have been obtained from Traffic Speed Reports 33, 40, 43, 45, 46, 50, 52, 54, 57, and 59, respectively, and are compared with the 1957 data in Table IV.

R

WEIG (KIP	STATION 81 AUGUST 30		STATION 5 AUGUST 14		SUMMARY		
	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	WEIGHT (KIPS)
0—	46.7	7	53.0	1	48.3	79	0—4
4—	48.7	33	49.3	12	49.7	233	4—5
TOT. TI	40		13		312		TOT. TRUCKS
AVG. WEI	4,200		4,400		4,200		AVG. WEIGHT (LB)
AVG. SP	48.3		49.6		49.3		AVG. SPEED
% EM	77.5		57.7		67.8		% EMPTY
5—	46.4	27	45.5	14	47.0	226	5—8
8—	42.6	31	38.7	7	43.6	196	8—12
12—	44.9	11	44.8	6	43.5	108	12—16
16—	41.7	15	35.0	2	43.5	61	16—20
20—	41.5	11	43.0	3	43.4	47	20—24
24—	46.0	4	54.0	1	47.4	13	24—28
28—			28.0	1	41.0	5	28—32
32—	39.0	2			45.0	9	32—36
36—					43.4	9	36—40
40—					36.0	1	40—44
44—					38.0	1	44—48
TOT. TI	101		34		716		TOT. TRUCKS
AVG. WEI	12,800		11,200		11,622		AVG. WEIGHT (LB.)
AVG. SP	43.7		42.9		44.9		AVG. SPEED
% E	38.6		32.4		37.3		% EMPTY

TABLE I SINGLE UNIT TRUCK SPEEDS IN MILES PER HOUR

WEIGHT (KIPS)	STATION 68 AUGUST 5		STATION 45-8 AUGUST 8		STATION 4 AUGUST 15		STATION 2 AUGUST 16		STATION 14 AUGUST 21		STATION 42 AUGUST 26		STATION 58-8 AUGUST 27		STATION 75 AUGUST 28		STATION 81 AUGUST 30		STATION 5 AUGUST 14		SUMMARY		WEIGHT (KIPS)
	AVG SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	
0 — 4	42.1	12	42.3	8	51.3	7	55.0	1	47.2	6	61.7	3	55.5	12	47.3	22	46.7	7	53.0	1	48.3	79	0 — 4
4 — 5	43.5	11	45.1	14	47.2	22	49.9	7	47.9	21	57.7	16	51.3	42	50.7	55	48.7	33	49.3	12	49.7	233	4 — 5
TOT. TRUCKS	23		22		29		8		27		19		54		77		40		13		312		TOT. TRUCKS
AVG. WEIGHT(LB)	4,100		4,100		4,200		4,200		4,200		4,300		4,200		4,200		4,200		4,400		4,200		AVG. WEIGHT (LB)
AVG. SPEED	42.7		44.1		48.2		50.5		47.7		58.3		52.2		49.7		48.3		49.6		49.3		AVG. SPEED
% EMPTY	56.5		81.8		48.3		50.0		63.0		68.4		53.7		84.4		77.5		57.7		67.8		% EMPTY
5—8	39.3	12	46.8	18	43.6	33	44.9	9	49.5	17	50.1	41	49.1	53	46.9	42	46.4	27	45.5	14	47.0	226	5—8
8—12	41.0	6	40.9	20	42.1	24	45.4	13	46.8	18	46.4	17	44.4	38	43.7	22	42.6	31	38.7	7	43.6	196	8—12
12—16	39.5	10	40.2	14	42.4	16	43.6	5	46.0	9	47.9	11	44.8	13	43.2	13	44.9	11	44.8	6	43.5	108	12—16
16—20	42.0	4	39.0	1	44.8	4	45.2	6	43.7	3	48.0	7	44.6	11	43.0	8	41.7	15	35.0	2	43.5	61	16—20
20—24	47.5	2	45.0	1	43.0	7	56.0	2	45.2	6	41.5	2	40.8	6	43.4	7	41.5	11	43.0	3	43.4	47	20—24
24—28			46.0	1	47.0	2			49.0	1	44.0	2	48.0	1	53.1	1	46.0	4	54.0	1	47.4	13	24—28
28—32							49.0	1	45.0	1	41.5	2							28.0	1	41.0	5	28—32
32—36							51.5	2	48.0	1	46.3	3	37.0	1			39.0	2			45.0	9	32—36
36—40									42.0	3	40.5	2	47.0	3	43.0	1					43.4	9	36—40
40—44															36.0	1					36.0	1	40—44
44—48			38.0	1																	38.0	1	44—48
TOT. TRUCKS	34		56		86		38		59		87		126		95		101		34		716		TOT. TRUCKS
AVG. WEIGHT (LB)	11,600		10,800		10,800		13,200		13,300		11,700		10,800		11,100		12,800		11,200		11,622		AVG. WEIGHT (LB)
AVG. SPEED	40.5		42.7		43.0		46.0		46.9		48.0		46.3		45.0		43.7		42.9		44.9		AVG. SPEED
% EMPTY	32.4		32.1		26.7		47.4		39.0		29.9		42.1		47.4		38.6		32.4		37.3		% EMPTY

ES PER HOUR

	STATION 81 AUG. 30, 1957		STATION 5 AUG. 14, 1957		SUMMARY		
	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	WEIGHT (KIPS)
							0 — 8
					52.0	2	8 — 12
	45.0	2	32.5	2	42.1	36	12 — 16
	47.7	12	39.7	12	43.5	124	16 — 20
	45.5	15	41.9	20	43.3	156	20 — 24
	43.3	3	39.4	12	43.5	118	24 — 28
	47.5	2	39.7	6	42.7	100	28 — 32
	44.5	11	37.3	6	43.3	99	32 — 36
	43.4	8	38.8	12	43.1	74	36 — 40
	44.3	3	39.3	12	42.3	62	40 — 44
	44.5	2	37.4	14	40.9	68	44 — 48
	42.2	5	39.0	9	40.2	80	48 — 52
	43.2	6	38.0	12	42.9	71	52 — 56
	42.5	2	38.5	10	41.5	48	56 — 60
	42.5	4	40.0	2	42.0	23	60 — 64
	39.5	2	38.8	4	37.0	24	64 — 68
	40.0	1	37.6	5	41.2	39	68 — 72
			37.8	4	40.4	23	72 — 76
	40.0	1			41.8	10	76 — 80
					40.5	2	80 — 84
					46.5	2	84 — 88
	79		142		1161		TOT. TRUCKS
	35,600		40,000		37,138		AVG. WT. (LBS.)
	44.5		39.0		42.5		AVG. SPEED (MPH)
	33.0		26.8		30.8		% EMPTY

TABLE II SEMI-TRAILERS (MULTIPLE UNITS) — SPEEDS IN MILES PER HOUR

WEIGHT (KIPS)	STATION 68 AUG. 5, 1957		STATION 45-B AUG. 8, 1957		STATION 4 AUG. 15, 1957		STATION 2 AUG. 16, 1957		STATION 14 AUG. 21, 1957		STATION 42 AUG. 26, 1957		STATION 75 AUG. 28, 1957		STATION 58-B AUG. 27, 1957		STATION 81 AUG. 30, 1957		STATION 5 AUG. 14, 1957		SUMMARY		WEIGHT (KIPS)
	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	
0 — 8																							0 — 8
8 — 12									52.0	1					52.0	1					52.0	2	8 — 12
12 — 16	40.8	4	41.0	7	39.5	4	44.0	2	46.5	6	41.7	3	49.0	1	42.4	5	45.0	2	32.5	2	42.1	36	12 — 16
16 — 20	36.6	10	40.6	10	41.2	15	45.5	11	47.9	15	44.9	14	41.8	9	45.6	16	47.7	12	39.7	12	43.5	124	16 — 20
20 — 24	37.2	9	40.4	17	43.1	19	44.6	24	46.1	13	42.9	15	45.0	8	45.5	16	45.5	15	41.9	20	43.3	156	20 — 24
24 — 28	40.9	16	39.4	7	43.3	8	44.6	15	47.1	14	46.0	13	41.3	10	46.0	20	43.3	3	39.4	12	43.5	118	24 — 28
28 — 32	36.9	20	41.4	7	42.1	11	43.1	12	47.1	15	44.3	9	45.3	3	45.6	15	47.5	2	39.7	6	42.7	100	28 — 32
32 — 36	38.3	6	40.8	11	38.9	11	47.5	13	46.4	17	42.8	12	45.8	5	45.7	7	44.5	11	37.3	6	43.3	99	32 — 36
36 — 40	39.0	4	43.0	2	45.2	9	43.8	10	46.9	7	42.6	7	40.0	2	44.8	13	43.4	8	38.8	12	43.1	74	36 — 40
40 — 44	41.3	3	40.7	7	41.0	3	43.4	9	45.3	8	42.4	7	43.3	3	44.1	7	44.3	3	39.3	12	42.3	62	40 — 44
44 — 48	35.4	7	40.0	9	42.8	4	43.2	10	44.8	10	42.3	4	43.6	5	41.0	3	44.5	2	37.4	14	40.9	68	44 — 48
48 — 52	33.3	7	37.7	11	38.7	3	42.2	11	43.5	11	43.3	7	39.8	9	41.1	7	42.2	5	39.0	9	40.2	80	48 — 52
52 — 56	40.9	7	42.0	6	42.3	6	44.3	10	48.4	7	43.5	4	43.5	4	45.7	9	43.2	6	38.0	12	42.9	71	52 — 56
56 — 60	42.7	3	38.0	4	36.0	2	41.8	9	44.0	10	42.5	2	43.0	2	45.5	4	42.5	2	38.5	10	41.5	48	56 — 60
60 — 64	46.0	2	42.0	3	34.5	2	43.5	2	45.8	4	38.3	3			45.0	1	42.5	4	40.0	2	42.0	23	60 — 64
64 — 68	30.0	2	34.0	1	37.0	1	37.0	1	31.9	7	41.0	2	45.0	4			39.5	2	38.8	4	37.0	24	64 — 68
68 — 72	32.0	1	34.0	2	36.6	5	42.4	5	46.3	9	41.6	5	44.3	3	42.0	3	40.0	1	37.6	5	41.2	39	68 — 72
72 — 76	41.0	3	37.0	2	37.5	2	41.4	5	46.3	3			42.0	1	39.3	3			37.8	4	40.4	23	72 — 76
76 — 80			41.5	2	36.0	1	44.0	3	44.0	2					39.0	1	40.0	1			41.8	10	76 — 80
80 — 84									48.0	1					33.0	1					40.5	2	80 — 84
84 — 88	45.0	1							48.0	1											46.5	2	84 — 88
TOT. TRUCKS	105		108		106		152		161		107		69		132		79		142		1161		TOT. TRUCKS
AVG. WT. (LBS.)	34,200		36,900		34,500		38,900		40,600		34,700		38,200		34,800		35,600		40,000		37,138		AVG. WT. (LBS.)
AVG. SPEED (MPH)	38.2		40.1		41.3		44.0		45.6		43.4		43.0		44.7		44.5		39.0		42.5		AVG. SPEED (MPH)
% EMPTY	21.9		27.8		31.1		29.6		29.2		43.0		34.8		34.8		33.0		26.8		30.8		% EMPTY

TABLE III

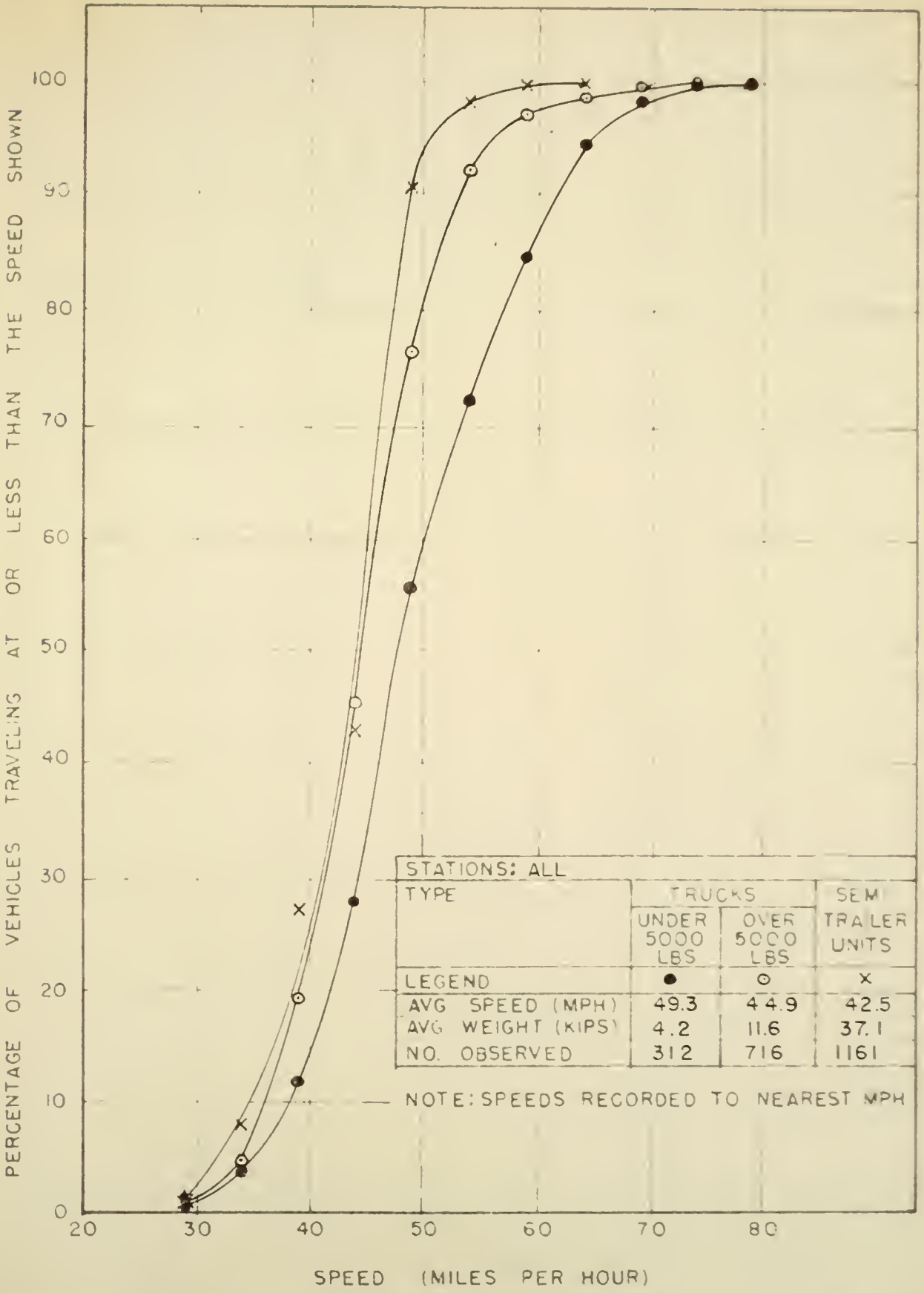
VEHICLES EXCEEDING SPEED LIMIT

STATION	Trucks Weighing Under 5000 Lbs.*			Trucks Weighing Over 5000 Lbs.**			Multiple Units**		
	No. Noted	% Exceeding 65 MPH	%Exceeding*** 70 MPH	No. Noted	%Exceeding 45 MPH	%Exceeding*** 50 MPH	No. Noted	%Exceeding 45 MPH	%Exceeding*** 50 MPH
68	23	0	0	34	14.7	0	105	8.6	1.0
45.B	22	0	0	56	30.4	10.7	108	14.8	2.8
4	29	3.4	0	86	32.6	10.5	106	22.6	6.6
2	8	0	0	38	44.7	18.4	152	36.2	5.9
14	27	0	0	59	57.6	15.3	161	60.2	11.8
42	19	15.8	5.3	87	57.5	31.0	107	32.7	0.9
58-B	54	5.6	0	126	50.8	18.3	132	40.2	11.4
75	77	3.9	0	95	43.2	15.8	69	26.1	5.8
81	40	0	0	101	34.7	9.9	79	38.0	12.7
5	13	7.7	0	34	44.1	11.8	142	7.7	0.7
SUMMARY	312	3.5	0.3	716	42.7	15.4	1161	30.0	6.0

* Indiana State Speed Limit for Trucks with gross-weight less than 5000 Lbs. is 65 M.P.H.

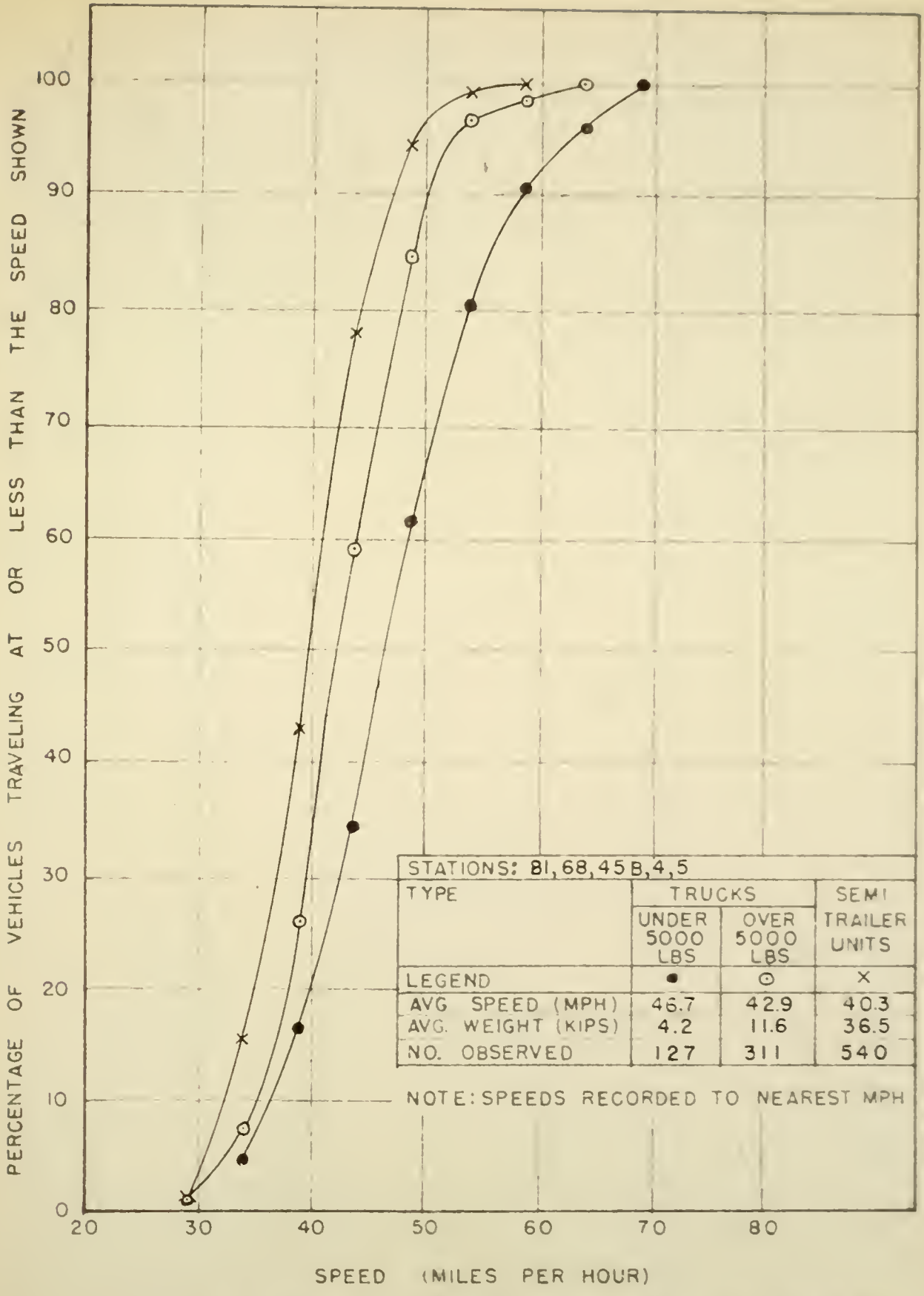
** Indiana State Speed Limit for trucks with gross-weight 5000 lbs. or more is 45 M.P.H.

*** The Enforcement Speed Limit is usually considered to be the legal speed limit plus 5 M.P.H.



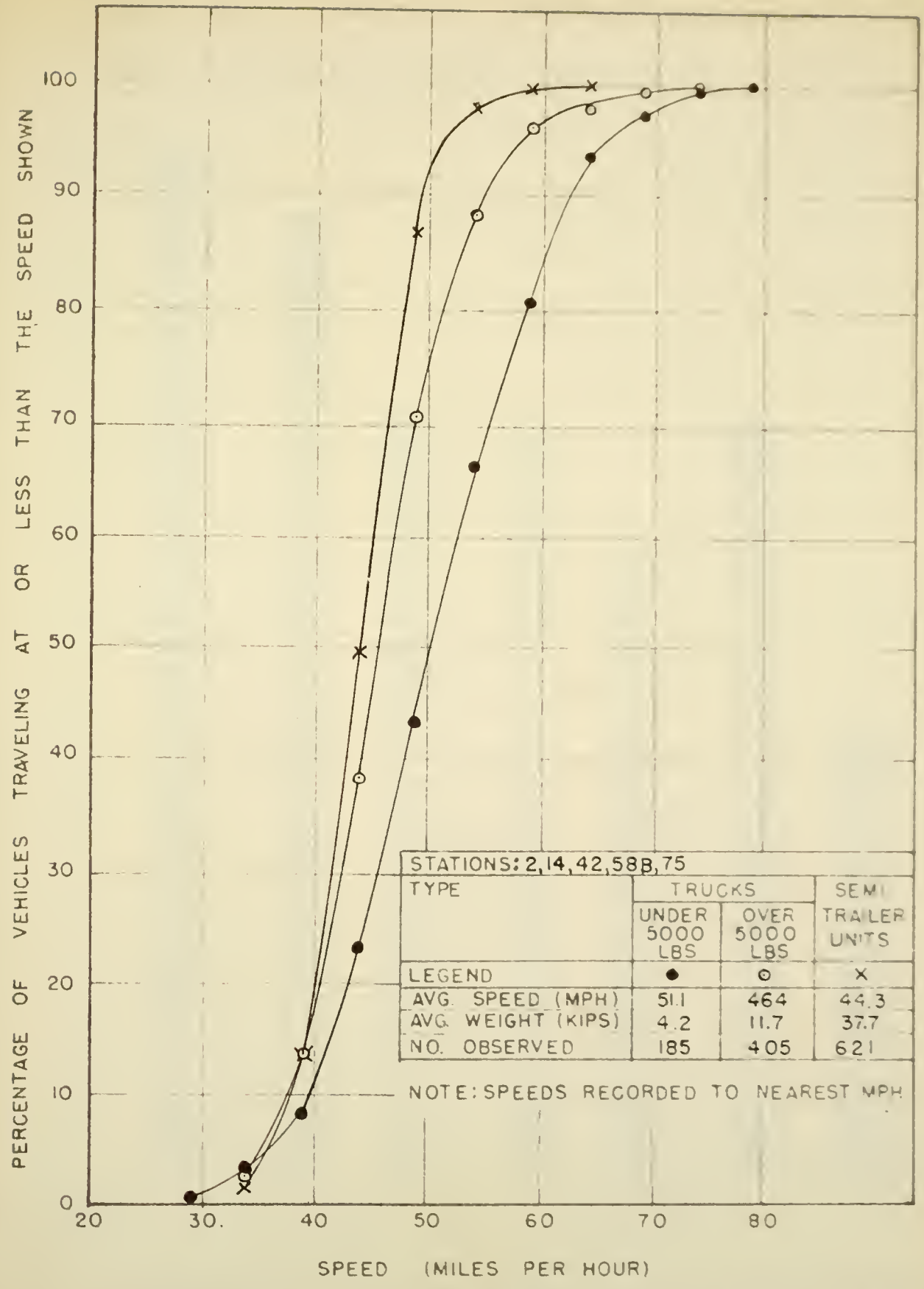
SPEED ACCUMULATION CURVES FOR ALL HIGHWAYS

FIG. 2



SPEED ACCUMULATION CURVES FOR TWO-LANE HIGHWAYS

FIG. 3

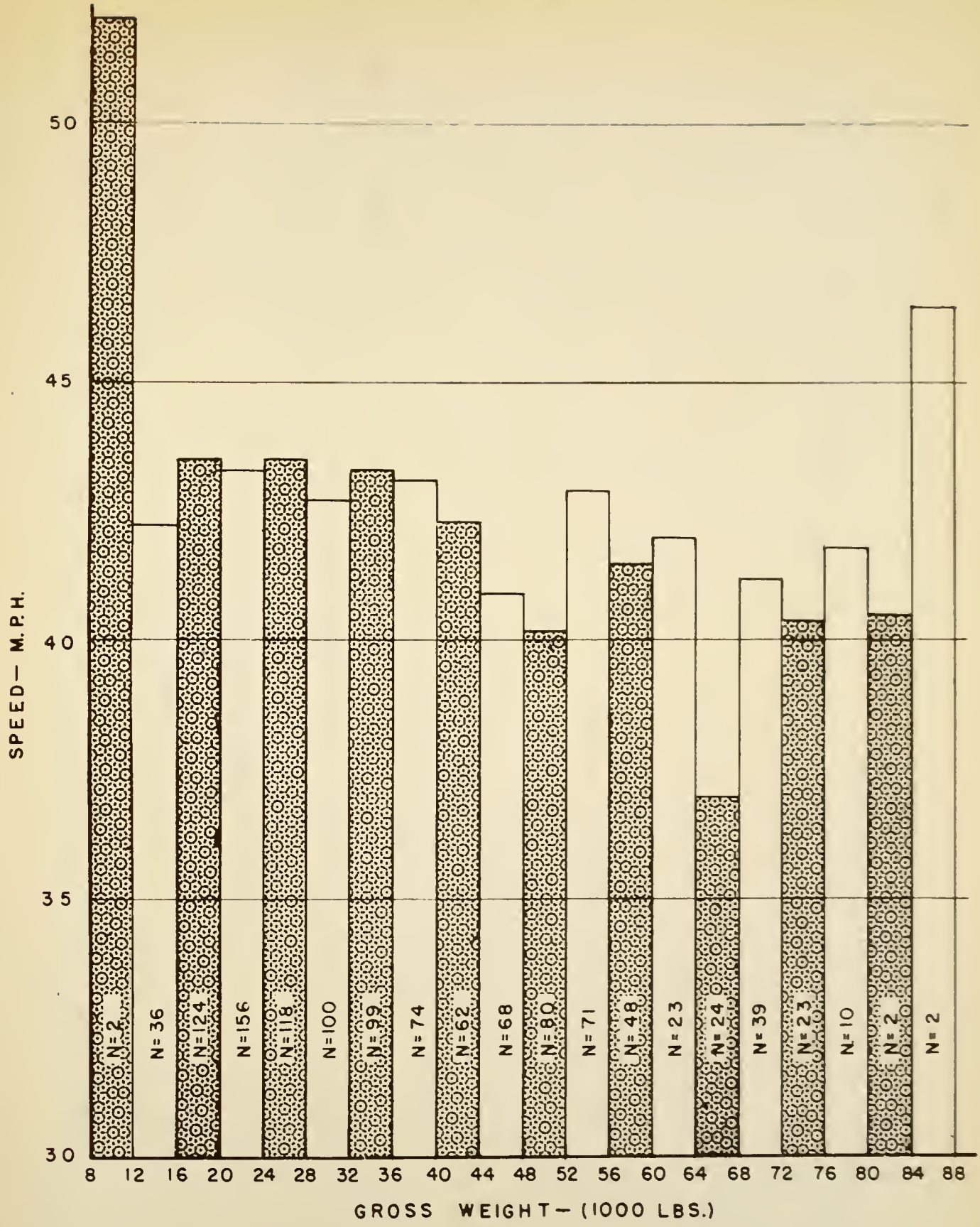


SPEED ACCUMULATION CURVES FOR FOUR-LANE HIGHWAYS

FIG. 4

AVERAGE SPEED VS. GROSS WEIGHT FOR SINGLE UNITS

FIG. 5



AVERAGE SPEED VS. GROSS WEIGHT FOR SEMI-TRAILERS

FIG. 6

TABLE IV

TRUCK WEIGHT-SPEED DATA
COMPARISON OF DATA FROM STUDIES IN VARIOUS YEARS

	1946	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957
No. of Single-Unit Trucks	839	493	578	791	1242	1482	1239	905	762	952	1026
Ave. Speed of * Single-Unit Trucks	40.0	42.4	42.2	42.4	43.0	43.4	43.9	45.8	45.9	47.0	46.3
Ave. Weight of * Single-Unit Trucks	6,600	8,800	9,400	8,700	8,600	8,700	8,400	8,000	8,900	8,300	9,400
No. of Semi-Trailers	586	627	581	879	1402	1354	1507	1064	1120	[illegible]	1263
Ave. Speed of Semi-Trailers	39.8	42.7	43.2	42.7	43.5	44.1	43.1	43.6	43.5	44.4	42.5
Ave. Weight of Semi-Trailers	29,200	31,900	32,500	36,700	36,700	35,900	35,800	37,400	38,400	37,900	37,100

SUMMARY OF RESULTS

From Tables I and II the Following Observations Are Made:

Single Unit Trucks with a gross weight of less than 5,000 lbs.

Number of vehicles observed	312
Average Speed	49.3 MPH
Average Weight	4,200 lbs.
Percent empty	67.8

Single Unit Trucks with a gross weight of 5,000 lbs. or more:

Number of vehicles observed	716
Average Speed	44.9 MPH
Average Weight	11,622 lbs.
Percent empty	37.3

All Single Unit Trucks:

Number of vehicles observed	1028
Average Speed	46.2 MPH
Average Weight	9,369 lbs.
Percent empty	46.6

Semi-Trailers (Multiple Units):

Number of Vehicles Observed	1161
Average Speed	42.5 MPH
Average Weight	37,138 lbs.
Percent empty	30.8

The data obtained during the 1957 study indicate that the average speed of single-unit trucks weighing more than 5,000 pounds increased 0.1 miles per hour since 1956, while the average speed of multiple unit trucks has decreased by 1.9 miles per hour.

When compared with average weights obtained in the 1956 study, the 1957 data show that the average weight of single unit trucks has increased approximately 1100 pounds and the average weight of multiple unit trucks has decreased about 800 pounds.

It was observed that 3.5 percent of the trucks weighing less than 5,000 pounds were exceeding the legal speed limit of 65 miles per hour and only 0.3 percent were exceeding 70 miles per hour. In the case of single-unit trucks with gross weight greater than 5,000 pounds, 42.7 percent were exceeding the legal speed limit of 45 miles per hour and 15.4 percent were exceeding 50 miles per hour. Of the multiple-unit trucks observed, 30.0 percent were exceeding the legal speed limit of 45 miles per hour and 6.0 percent were exceeding 50 miles per hour.

These percentages indicate a decrease in speed violations of 0.7 percent for single-unit trucks weighing less than 5,000 pounds, 0.9 percent for single-unit trucks with gross weight greater than 5,000 pounds and 7.5 percent for multiple-unit trucks, when compared with 1956 percentages.